

WHAT IS CLAIMED IS:

1. A piezoelectric/electrostrictive film type device comprising:

a substrate formed of a ceramic,

5 at least one piezoelectric/electrostrictive portion formed of a piezoelectric/electrostrictive porcelain composition on the substrate, and

at least one pair of electrodes on the substrate, electrically connected to the

10 piezoelectric/electrostrictive portion and including a positive electrode and a negative electrode,

wherein the piezoelectric/electrostrictive porcelain composition contains a $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary solid solution system composition as a major

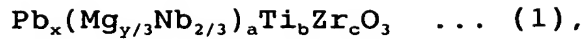
15 component, contains 0.05 to 3.0wt% of NiO, and contains 2.0 to 22.0 mol% of Si with respect to the total number of moles of Mg and Ni, and

the piezoelectric/electrostrictive portion is solidly attached onto the substrate directly or via the
20 positive electrode or the negative electrode.

2. The piezoelectric/electrostrictive film type device according to claim 1, wherein the

piezoelectric/electrostrictive porcelain composition

25 comprises the $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary solid solution system composition represented by the following general formula (1) as the major component:



where $0.95 \leq x \leq 1.05$, $0.8 \leq y \leq 1.0$, and a , b , c are decimal numbers in a range surrounded with $(a, b, c) =$
(0.550, 0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325,
5 0.300), (0.100, 0.425, 0.475), (0.100, 0.525, 0.375),
(0.375, 0.425, 0.200) in coordinates in which a , b , c are coordinate axes (additionally, $a+b+c = 1.00$).

3. A piezoelectric/electrostrictive film type
10 device comprising:

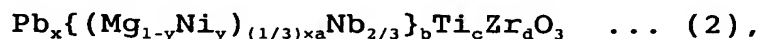
a substrate formed of a ceramic,

at least one piezoelectric/electrostrictive portion
formed of a piezoelectric/electrostrictive porcelain
composition on the substrate, and

15 at least one pair of electrodes on the substrate,
electrically connected to the
piezoelectric/electrostrictive portion and including a
positive electrode and a negative electrode,

wherein the piezoelectric/electrostrictive
20 porcelain composition contains a $\text{Pb}(\text{Mg}, \text{Ni})_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 -
 PbTiO_3 ternary solid solution system composition as a major
component, and contains 4.0 to 37.0 mol% of Si with respect
to the total number of moles of Mg and Ni, and the
piezoelectric/electrostrictive portion is solidly attached
25 onto the substrate directly or via the positive electrode
or the negative electrode.

4. The piezoelectric/electrostrictive film type device according to claim 3, wherein the piezoelectric/electrostrictive porcelain composition comprises the $\text{Pb}(\text{Mg}, \text{Ni})_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary solid solution system composition represented by the following general formula (2) as the major component:



where $0.95 \leq x \leq 1.05$, $0.05 \leq y \leq 0.20$, $0.90 \leq a \leq 1.10$, and b, c, d are decimal numbers in a range surrounded with (b, c, d) = (0.550, 0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325, 0.300), (0.100, 0.425, 0.475), (0.100, 0.525, 0.375), (0.375, 0.425, 0.200) in coordinates in which b, c, d are coordinate axes (additionally, $(b+c+d) = 1.000$).

5. The piezoelectric/electrostrictive film type device according to claim 1, comprising: a plurality of the piezoelectric/electrostrictive portions; and a plurality of pairs of the electrodes, wherein the plurality of piezoelectric/electrostrictive portions are alternately held/stacked via the positive electrodes and the negative electrodes of the plurality of pairs of electrodes.

6. The piezoelectric/electrostrictive film type device according to claim 3, comprising: a plurality of the piezoelectric/electrostrictive portions; and a plurality of pairs of the electrodes, wherein the plurality of piezoelectric/electrostrictive portions are alternately

held/stacked via the positive electrodes and the negative electrodes of the plurality of pairs of electrodes.

7. The piezoelectric/electrostrictive film type
5 device according to claim 1, wherein the
piezoelectric/electrostrictive portion has a thickness of 1
to 10 μm .

8. The piezoelectric/electrostrictive film type
10 device according to claim 3, wherein the
piezoelectric/electrostrictive portion has a thickness of 1
to 10 μm .

9. A piezoelectric/electrostrictive film type
15 device comprising:
a substrate formed of a ceramic,
a plurality of piezoelectric/electrostrictive
portions formed of a piezoelectric/electrostrictive
porcelain composition on the substrate, and
20 a plurality of pairs of electrodes on the substrate,
each electrically connected to the
piezoelectric/electrostrictive portion and each including a
positive electrode and a negative electrode;, the plurality
of piezoelectric/electrostrictive portions being
25 alternately held/stacked via the positive electrodes and
the negative electrodes of the plurality of pairs of
electrodes,

wherein the piezoelectric/electrostrictive
porcelain composition constituting at least one
piezoelectric/electrostrictive portion (first
piezoelectric/electrostrictive portion) contains a $\text{Pb}(\text{Mg},$
5 $\text{Ni})_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary solid solution system
composition as a major component, and contains 4.0 to 37.0
mol% of Si with respect to the total number of moles of Mg
and Ni, and

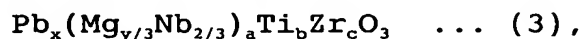
the piezoelectric/electrostrictive porcelain
10 composition constituting at least one
piezoelectric/electrostrictive portion (second
piezoelectric/electrostrictive portion) contains a
 $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary solid solution system
composition as the major component, contains 0.05 to 3.0wt%
15 of NiO, and contains 2.0 to 22.0 mol% of Si with respect to
the total number of moles of Mg and Ni.

10. The piezoelectric/electrostrictive film type
device according to claim 9, wherein the

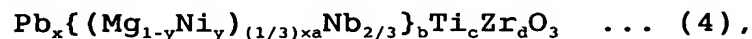
20 piezoelectric/electrostrictive porcelain composition
constituting the second piezoelectric/electrostrictive
portion comprises the $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary
solid solution system composition represented by the
following general formula (3) as the major component,

25 the piezoelectric/electrostrictive porcelain
composition constituting the first
piezoelectric/electrostrictive portion comprises the $\text{Pb}(\text{Mg},$

$\text{Ni}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary solid solution system
composition represented by the following general formula
(4) as the major component,



5 where $0.95 \leq x \leq 1.05$, $0.8 \leq y \leq 1.0$, and a , b , c are
decimal numbers in a range surrounded with $(a, b, c) =$
 $(0.550, 0.425, 0.025)$, $(0.550, 0.325, 0.125)$, $(0.375, 0.325,$
 $0.300)$, $(0.100, 0.425, 0.475)$, $(0.100, 0.525, 0.375)$,
 $(0.375, 0.425, 0.200)$ in coordinates in which a , b , c are
10 coordinate axes (additionally, $a+b+c = 1.00$).



where $0.95 \leq x \leq 1.05$, $0.05 \leq y \leq 0.20$, $0.90 \leq a \leq 1.10$,
and b , c , d are decimal numbers in a range surrounded with
 $(b, c, d) = (0.550, 0.425, 0.025)$, $(0.550, 0.325, 0.125)$,
15 $(0.375, 0.325, 0.300)$, $(0.100, 0.425, 0.475)$, $(0.100, 0.525,$
 $0.375)$, $(0.375, 0.425, 0.200)$ in coordinates in which b , c ,
 d are coordinate axes (additionally, $(b+c+d) = 1.000$).

11. The piezoelectric/electrostrictive film type
20 device according to claim 9, wherein each of the plurality
of piezoelectric/electrostrictive portions has a thickness
of 1 to 10 μm .

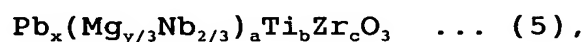
12. The piezoelectric/electrostrictive film type
25 device according to claim 9, wherein an Ni content of the
piezoelectric/electrostrictive porcelain composition
constituting the piezoelectric/electrostrictive portion of

a lowermost layer is smaller than that of the piezoelectric/electrostrictive porcelain composition constituting the piezoelectric/electrostrictive portion other than that of the lowermost layer.

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13. A piezoelectric/electrostrictive porcelain composition comprising: a $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary solid solution system composition as a major component; 0.05 to 3.0wt% of NiO; and 2.0 to 22.0 mol% of Si with
10 respect to the total number of moles of Mg and Ni.

14. The piezoelectric/electrostrictive porcelain composition according to claim 13, comprising: the $\text{PbMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary solid solution system
15 composition represented by the following general formula (5) as the major component:

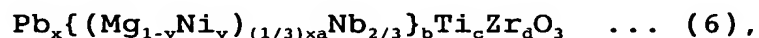


where $0.95 \leq x \leq 1.05$, $0.8 \leq y \leq 1.0$, and a, b, c are decimal numbers in a range surrounded with (a, b, c) =
20 (0.550, 0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325, 0.300), (0.100, 0.425, 0.475), (0.100, 0.525, 0.375), (0.375, 0.425, 0.200) in coordinates in which a, b, c are coordinate axes (additionally, $a+b+c = 1.00$).

25 15. A piezoelectric/electrostrictive porcelain composition comprising: a $\text{Pb}(\text{Mg}, \text{Ni})_{1/3}\text{Nb}_{2/3}\text{O}_3$ - PbZrO_3 - PbTiO_3 ternary solid solution system composition as a major

component; and 4.0 to 37.0 mol% of Si with respect to the total number of moles of Mg and Ni.

16. The piezoelectric/electrostrictive porcelain composition according to claim 15, comprising: the Pb(Mg, Ni)_{1/3}Nb_{2/3}O₃-PbZrO₃-PbTiO₃ ternary solid solution system composition represented by the following general formula (6) as the major component:



where $0.95 \leq x \leq 1.05$, $0.05 \leq y \leq 0.20$, $0.90 \leq a \leq 1.10$, and b, c, d are decimal numbers in a range surrounded with (b, c, d) = (0.550, 0.425, 0.025), (0.550, 0.325, 0.125), (0.375, 0.325, 0.300), (0.100, 0.425, 0.475), (0.100, 0.525, 0.375), (0.375, 0.425, 0.200) in coordinates in which b, c, d are coordinate axes (additionally, $(b+c+d) = 1.000$).